

PATENT ABSTRACTS OF JAPAN

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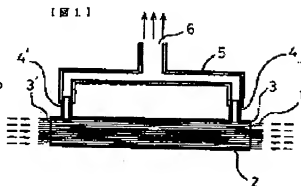
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(54) METHOD AND APPARATUS FOR DRYING HOLLOW FIBER BUNDLE

(57)Abstract:

PROBLEM TO BE SOLVED: To selectively and efficiently dry only the moisture-containing end parts of a hollow fiber bundle in a process prior to forming a module of the hollow fiber bundle.

SOLUTION: In a method for drying the hollow fiber bundle, a cylindrical body, which houses the hollow yarn bundle and has an opening part at least at one end thereof and has a venting hole separately from the opening part, is provided and an air pipe is connected to the venting hole to supply air to the opening part and venting hole of the cylindrical body.



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CLAIMS

[Claim(s)]

[Claim 1] The desiccation approach of the hollow filament bundle characterized by for an end carrying out opening at least, and connecting a vent pipe to the above-mentioned bleeder of the tube-like object which stores a hollow filament bundle, and which has a bleeder apart from the above-mentioned opening, and carrying out aeration to opening and the bleeder of the above-mentioned tube-like object.

[Claim 2] The desiccation approach of the hollow filament bundle characterized by for an end carrying out opening at least, and connecting a vent pipe to the above-mentioned bleeder of the tube-like object which stores a hollow filament bundle, and which has a bleeder apart from the above-mentioned opening, carrying out suction aeration from the bleeder of the above-mentioned tube-like object, and exhausting from opening.

[Claim 3] The desiccation approach of the hollow filament bundle according to claim 1 or 2 characterized by the above-mentioned tube-like object being casing of a hollow fiber module.

[Claim 4] The desiccation approach of the hollow filament bundle characterized by for an end carrying out opening at least, and connecting a vent pipe to the above-mentioned bleeder of the tube-like object which prepared the member which stores a hollow filament bundle, and which blockades a part of above-mentioned opening, and carrying out aeration to opening and the bleeder of the above-mentioned tube-like object while having a bleeder apart from the above-mentioned opening.

[Claim 5] The desiccation approach of the hollow filament bundle characterized by for an end carrying out opening at least, and connecting a vent pipe to the above-mentioned bleeder of the tube-like object which prepared the member which stores a hollow filament bundle, and which blockades a part of above-mentioned opening while having the bleeder apart from the above-mentioned opening, carrying out suction aeration from the bleeder of the above-mentioned tube-like object, and exhausting from opening.

[Claim 6] The desiccation approach of the hollow filament bundle according to claim 4 or 5 characterized by the above-mentioned tube-like object being casing of a hollow fiber module.

[Claim 7] The dryer of the hollow filament bundle which an end carries out opening at least, and is characterized by having the vent pipe connected with the above-mentioned bleeder, and the device in which mind the above-mentioned vent pipe, and a gas is ventilated and/or attracted to the above-mentioned bleeder, in the tube-like object which stores a hollow filament bundle, and which has a bleeder apart from the above-mentioned opening.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention offers the desiccation approach of the hollow filament bundle which can dry only an edge for the moisture which the hollow filament bundle end section contains alternatively and efficiently about the last process which carries out the modularization of the hollow filament bundle, and a dryer.

[0002]

[Description of the Prior Art] The hollow fiber module is widely used for an artificial kidney, an artificial liver, an artificial lung, plasma skimming, the ultrafiltration, the water purifier, etc., and is better known than before about many operation gestalten and various applications.

[0003] In bundling two or more hollow filaments and carrying out a nothing modularization to a hollow filament bundle, the manufacture approach which fixes the hollow filament bundle end section to casing by resin is common. At this time, it is required that the moisture of a hollow filament bundle should be dried moderately so that a reaction with unnecessary moisture and above-mentioned resin which a hollow filament bundle contains may not be caused.

[0004] As the conventional desiccation approach, it is common to put a hollow filament bundle into ordinary temperature or the thermostatic chamber of dry air. However, long duration is required for mass-producing, or a large-scale desiccation thermostatic chamber is required.

[0005] Although the approach for drying efficiently to JP,6-10208,A that the above should be improved is indicated, by the above-mentioned approach, the hollow filament bundle center section which is unrelated to immobilization by resin is also dried. Drying a thread center section superfluously affects the hole structure of a hollow fiber, and it has a possibility that the engine performance to expect may not be obtained to dialysis or filtration.

[0006] Although there is an approach indicated by JP,4-256423,A about how to dry only an edge alternatively, it is necessary to connect coupling to sheath both ends. That is, after it evacuates to sheath shaft orientations and coupling awaits a sheath, after checking sheath arrival, coupling must be moved, it must connect with a sheath, and it becomes complicated [the device of equipment]. Moreover, the diameter of opening of a sheath will be limited to a coupling function, and a degree of freedom is missing from a viewpoint of other form mass production.

[0007]

[Problem(s) to be Solved by the Invention] This invention aims at offering the desiccation approach of the hollow filament bundle which can dry the edge of a hollow filament bundle alternatively and efficiently for the purpose of solving the technical problem in the above-mentioned conventional technique, and a dryer.

[0008]

[Means for Solving the Problem] That the above-mentioned purpose should be attained, as a result of this invention persons' inquiring wholeheartedly, this invention shown below was reached.

[0009] That is, the desiccation approach of the hollow filament bundle of this invention according to claim 1 is characterized by for an end carrying out opening at least, and

connecting a vent pipe to the above-mentioned bleeder of the tube-like object which stores a hollow filament bundle and which has a bleeder apart from the above-mentioned opening, and carrying out aeration to opening and the bleeder of the above-mentioned tube-like object.

[0010] The location of the above-mentioned opening determines whether only the die length of which dries the edge of the above-mentioned hollow filament bundle alternatively. As for opening and the above-mentioned vent hole of the above-mentioned tube-like object, corresponding by one to one is desirable. That is, if one and a tube-like object have opening to both ends, two places of a vent hole are desirable [a vent hole], if the number of openings of the above-mentioned tube-like object is one.

[0011] The desiccation approach of the hollow filament bundle of this invention according to claim 2 is characterized by for an end carrying out opening at least, and connecting a vent pipe to the above-mentioned bleeder of the tube-like object which stores a hollow filament bundle and which has a bleeder apart from the above-mentioned opening, carrying out suction aeration from the bleeder of the above-mentioned tube-like object, and exhausting from opening.

[0012] By attracting a desiccation gas from the above-mentioned vent hole, the direction which made the desiccation gas ventilate from the above-mentioned tube-like object opening to a vent hole can carry out more certainly drying the edge of the above-mentioned hollow filament bundle alternatively.

[0013] The desiccation approach of the hollow filament bundle of this invention according to claim 3 is characterized by the above-mentioned tube-like object being casing of a hollow fiber module.

[0014] If casing of a hollow fiber module is used as a tube-like object of desiccation, it can shift to degree process promptly and a production process can be simplified. That is, use the first fluid opening of the above-mentioned casing as opening, and let the second fluid opening be a vent hole.

[0015] An end carries out opening at least, and the desiccation approach of the hollow filament bundle of this invention according to claim 4 is characterized by connecting a vent pipe to the above-mentioned bleeder of the tube-like object which prepared the member which stores a hollow filament bundle, and which blockades a part of above-mentioned opening, and carrying out aeration to opening and the bleeder of the above-mentioned tube-like object while having a bleeder apart from the above-mentioned opening.

[0016] It can prevent that a desiccation gas bypasses and the gap of a hollow filament [in / for a desiccation gas / a hollow filament bundle] can be made to ventilate certainly by blockading openings other than the hollow filament bundle in opening of the above-mentioned tube-like object by the above-mentioned member.

[0017] An end carries out opening at least, and the desiccation approach of the hollow filament bundle of this invention according to claim 5 is characterized by connecting a vent pipe to the above-mentioned bleeder of the tube-like object which prepared the member which stores a hollow filament bundle, and which blockades a part of above-mentioned opening, carrying out suction aeration from the bleeder of the above-mentioned tube-like object, and exhausting from opening while having a bleeder apart from the above-mentioned opening.

[0018] The desiccation approach of the hollow filament bundle of this invention according to claim 6 is characterized by the above-mentioned tube-like object being casing of a hollow fiber module.

[0019] An end carries out opening at least, and the dryer of the hollow filament bundle of this invention according to claim 7 is characterized by having the vent pipe connected with the above-mentioned bleeder, and the device in which mind the above-mentioned vent pipe, and a gas is ventilated and/or attracted to the above-mentioned bleeder in the tube-like object for which a hollow filament bundle is stored and which has a bleeder apart from the above-mentioned opening.

[0020] If the configuration of a bleeder is set constant, it is not influenced by the diameter of a hollow filament bundle, but since desiccation can be continued without changing the configuration of a bleeder linkage, it is suitable for multi-form mass production.

[0021]

[Embodiment of the Invention] Next, the example of this invention is explained to a detail using a drawing. In addition, this example does not restrict the gestalt of this invention.

[0022] Drawing 1 is the schematic diagram showing an example of the hollow filament bundle desiccation approach of this invention.

[0023] In drawing 1, 2 is a cylinder object which stores the hollow filament bundle 1, and opening 3 and 3' are prepared in the direction both ends of a major axis of this cylinder object, respectively. Moreover, a bleeder 4 and 4' are prepared in the lateral portion [/ near the both ends of this tube-like object], respectively. This bleeder 4 and the vent pipe 5 which opens 4' for free passage are further attached in this bleeder 4 and 4' free [attachment and detachment]. In addition, each bleeder 4 and gas ***** 6 which discharges a desiccation gas to installation or the exterior inside in the middle of piping which opens 4' for free passage are formed in the vent pipe 5.

[0024] Since the bleeder 4 of a vent pipe 5 and the entry to 4' should just insert a bleeder 4 and 4' to a vent pipe 5 when installing the cylinder object 2 in a dryer in a production process by manufacturing at a bleeder 4 and the same spacing as 4', it is not necessary to make a vent pipe 5 into working.

[0025] The gas with which desiccation of the hollow filament bundle 1 is presented is sent into a bleeder 4 and 4' from gas ***** 6 of a vent pipe 5, passes through the inside of the hollow filament bundle 1, and is discharged by opening 3. Or it passes through the inside of the hollow filament bundle 1 from opening 3, is drawn in by the vent pipe 5 from a bleeder 4 and 4', and is discharged from gas ***** 6. Only the edge of the hollow filament bundle 1 can be made to pass efficiently the gas with which desiccation is presented by the above.

[0026] In the above, to the diameter of the hollow filament bundle 1, if the diameter of opening 3 is large, a desiccation gas passes through the side face of the hollow filament bundle 1, and efficient desiccation cannot be realized. Therefore, ** which prevents the bypass of a desiccation gas using the hollow filament bundle 1, opening 3, the lock out member 7 that blockades the clearance between 3', and 7' is possible as shown in drawing 2.

[0027] As a material of the hollow filament bundle 1, a cellulose, polymethylmethacrylate, polypropylene, Pori Sall John, etc. are mentioned. About the material of the cylinder object 2 and the member 7 to blockade, if endurance is searched for and it will ask for lightweight nature using steel materials, resin can be used.

[0028] Although a desiccation gas changes with a hollow filament bundle material and drying effects to search for, it is desirable to consider as the temperature and humidity which do not spoil the filtration or the dialysis engine performance for which a hollow filament is asked.

[0029] In addition, as shown in drawing 3 as a tube-like object, the hollow fiber module casing 8 may be used. Moreover, as shown in the equipment of drawing 3 R> 3, the lock out member 7 and 7' may be used further.

[0030] Moreover, as for opening 3 and 3', either may be blockaded.

[0031]

[Example] It explains using example 1 drawing 3. 14,688 Pori Sall John hollow filaments containing a glycerol water solution were cut to an even length in the length of 248mm, and the hollow filament bundle 1 with a diameter of 45mm was formed. The above-mentioned hollow filament bundle 1 was inserted in the 52mm hollow fiber module casing 8 of the bore of 46.5mm, and the diameter of opening. Furthermore, the member 7 for blockading the casing opening 3 and a part of 3' and 7' were attached in the opening 3 of the above-mentioned casing, and 3', and aperture of opening 3 and 3' was set to the 45 samemm as the above-mentioned hollow filament bundle diameter. And after putting on the desiccation ambient atmosphere of the temperature of 40**2 degrees C, and 5**3% of humidity gently, when it drew in and dried from gas ***** 6 prepared in the vent pipe 5, the amount of desiccation of an average of 8.8g (n=3) was obtained by suction for 12 minutes, the airflow computed from the suction wind speed -- for 12 minutes -- 12.5m3 it was. That is, in order to obtain the amount of desiccation of 1g, it is 3 1.4m. Dry air was required.

It explains using example drawing 4 of a comparison. The hollow filament bundle 1 created like the example 1 is inserted in the hollow fiber module casing 8, and it is dry air of the temperature of 40**2 degrees C, and 5**3% of humidity per minute 2.4m from the both ends of the above-mentioned casing 3. The amount of desiccation of an average of 10.0g (n= 4) was obtained by the spraying for 11 minutes with sprayed ** at the time. That is, in order to obtain the amount of desiccation of 1g, it is 3 2.6m. Dry air was required.

[0032]

[Effect of the Invention] As mentioned above, the effectiveness that the above-mentioned opening dries the edge of a hollow filament bundle alternatively and efficiently by consisting of a tube-like object which has a bleeder independently, and using the desiccation approach of the hollow filament bundle characterized by carrying out aeration to opening and the bleeder of the above-mentioned tube-like object within a desiccation ambient atmosphere is done so by at least one side which stores a hollow filament bundle and the above-mentioned thread according to this invention and to store carrying out opening. Made it that the diameter of tube-like object opening and a hollow filament bundle diameter are the same, or more effective still more preferably, as an example shows to approximate.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the schematic diagram showing an example of the hollow filament bundle desiccation approach of this invention.

[Drawing 2] It is the hollow filament bundle desiccation approach of this invention, and is the schematic diagram showing the example at the time of attaching the member which blockades a part of tube-like object opening.

[Drawing 3] It is the hollow filament bundle desiccation approach of this invention, and is the schematic diagram showing the example at the time of using hollow fiber module casing as a tube-like object.

[Drawing 4] It is the schematic diagram of the equipment used for the example of a comparison.

[Description of Notations]

- 1: Hollow filament bundle
- 2: Tube-like object
- 3 3': Opening
- 4 4': Bleeder
- 5: Vent pipe
- 6: Gas *****
- 7 7': The member to blockade
- 8: Hollow fiber module casing
- 9 9': The 2nd fluid opening

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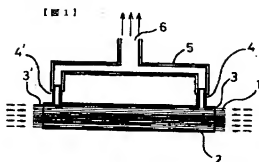
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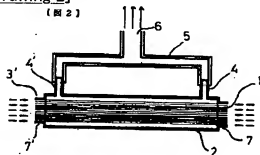
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DRAWINGS

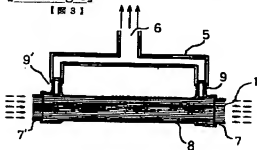
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Drawing 4]



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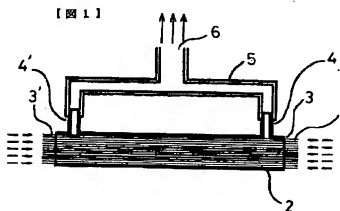
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(54)【発明の名称】 中空糸束の乾燥方法および乾燥装置

(57)【要約】

【課題】中空糸束をモジュール化する前工程について、中空糸束端部が含有する水分を端部のみを選択的かつ効率よく乾燥せしめることを目的とする。

【解決手段】中空糸束と、上記糸束を格納する格納する少なくとも一方が開口し、かつ、上記開口部とは別に通気口を有する筒状体からなり、通気管に上記通気口を接続して上記筒状体の開口部と通気口とに通気せしめることを特徴とする中空糸束の乾燥方法。



【特許請求の範囲】

【請求項1】中空糸束を格納する少なくとも一端が開口し、かつ、上記開口部とは別に通気口を有する筒状体の、上記通気口に通気管を接続して上記筒状体の開口部と通気口とに通気せしめることを特徴とする中空糸束の乾燥方法。

【請求項2】中空糸束を格納する少なくとも一端が開口し、かつ、上記開口部とは別に通気口を有する筒状体の、上記通気口に通気管を接続して上記筒状体の通気口から吸引通気せしめ開口部から排気することを特徴とする中空糸束の乾燥方法。

【請求項3】上記筒状体が中空糸モジュールのケーシングであることを特徴とする請求項1または2に記載の中空糸束の乾燥方法。

【請求項4】中空糸束を格納する少なくとも一端が開口し、かつ、上記開口部とは別に通気口を有するとともに、上記開口部の一部を閉塞する部材を設けた筒状体の、上記通気口に通気管を接続して上記筒状体の開口部と通気口とに通気せしめることを特徴とする中空糸束の乾燥方法。

【請求項5】中空糸束を格納する少なくとも一端が開口し、かつ、上記開口部とは別に通気口を有するとともに、上記開口部の一部を閉塞する部材を設けた筒状体の、上記通気口に通気管を接続して上記筒状体の通気口から吸引通気せしめ開口部から排気することを特徴とする中空糸束の乾燥方法。

【請求項6】上記筒状体が中空糸モジュールのケーシングであることを特徴とする、請求項4または5に記載の中空糸束の乾燥方法。

【請求項7】中空糸束を格納する少なくとも一端が開口し、かつ、上記開口部とは別に通気口を有する筒状体において、上記通気口に連結する通気管と、上記通気管を介して上記通気口に気体を送風および／または吸引する機構とを有することを特徴とする中空糸束の乾燥装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、中空糸束をモジュール化する前工程について、中空糸束端部が含有する水分を端部のみを選択的かつ効率よく乾燥させることが可能な中空糸束の乾燥方法および乾燥装置を提供するものである。

【0002】

【従来の技術】従来より中空糸モジュールは人工腎臓、人工肝臓、人工肺、血漿分離、限外濾過、浄水器、等に広く利用されており、幾多の実施形態と多種多様の用途に関して公知である。

【0003】中空糸を複数本束ねて中空糸束となしモジュール化するにあたっては、中空糸束端部を樹脂でケーシングに固定する製造方法が一般的である。この時、中空糸束が含有する水分と上記樹脂とが無用の反応を起こ

さないように、中空糸束の水分を適度に乾燥することが要求される。

【0004】従来の乾燥方法としては、中空糸束を常温または乾燥空気恒温室内に静置することが一般的である。しかしながら大量生産するには長時間を要するか、または大規模な乾燥恒温室が必要である。

【0005】上記を改善すべく特開平6-10208号公報に効率よく乾燥するための方法が記載されているが、上記方法では樹脂による固定とは関係がない中空糸束中央部をも乾燥する。糸束中央部を不必要に乾燥することは中空糸束の孔構造に影響を及ぼし、透析または濾過に対して、期待する性能が得られないおそれがある。

【0006】端部のみを選択的に乾燥する方法については特開平4-256423号公報に記載されている方法があるが、シース両端部にカップリングを接続する必要がある。すなわち、カップリングはシース軸方向に退避してシースを待ち受けた後、シース到着を確認してからカップリングを移動させてシースに接続しなければならず、装置の機構は複雑となる。また、カップリング機能に対してシースの開口径が限定されてしまい、他品種量産の観点からは自由度に欠ける。

【0007】

【発明が解決しようとする課題】本発明は、上記従来技術における課題を解決することを目的とし、中空糸束の端部を選択的かつ効率よく乾燥させることが可能な中空糸束の乾燥方法および乾燥装置を提供することを目的とする。

【0008】

【課題を解決するための手段】上記目的を達成すべく、本発明者らが鋭意検討した結果、以下に示す本発明に到達した。

【0009】すなわち、請求項1に記載の本発明の中空糸束の乾燥方法は、中空糸束を格納する少なくとも一端が開口し、かつ、上記開口部とは別に通気口を有する筒状体の、上記通気口に通気管を接続して上記筒状体の開口部と通気口とに通気せしめることを特徴としたものである。

【0010】上記開口部の位置により、上記中空糸束の端部をどれだけの長さだけ選択的に乾燥させるかを決定する。上記筒状体の開口部と上記通気口とは、一対一で対応することが望ましい。すなわち、上記筒状体の開口部が一つなら通風口も一つ、筒状体が両端に開口部を有すれば、通風口は二カ所が望ましい。

【0011】請求項2に記載の本発明の中空糸束の乾燥方法は、中空糸束を格納する少なくとも一端が開口し、かつ、上記開口部とは別に通気口を有する筒状体の、上記通気口に通気管を接続して上記筒状体の通気口から吸引通気せしめ開口部から排気することを特徴としたものである。

【0012】上記通風口から乾燥気体を吸引すること

で、上記筒状体開口部から通風口へと乾燥気体を通風させた方が、上記中空糸束の端部を選択的に乾燥させることをより確実に実施できる。

【0013】請求項3に記載の本発明の中空糸束の乾燥方法は、上記筒状体が中空糸モジュールのケーシングであることを特徴としたものである。

【0014】中空糸モジュールのケーシングを乾燥の筒状体として用いれば、速やかに次工程へと移行でき、製造工程を簡素化することができる。すなわち、上記ケーシングの第一流体口を開口部とし、第二流体口を通風口とする。

【0015】請求項4に記載の本発明の中空糸束の乾燥方法は、中空糸束を格納する少なくとも一端が開口し、かつ、上記開口部とは別に通気口を有するとともに、上記開口部の一部を閉塞する部材を設けた筒状体の、上記通気口に通気管を接続して上記筒状体の開口部と通気口とに通気せしめることを特徴としたものである。

【0016】上記筒状体の開口部における中空糸束以外の空隙を上記部材により閉塞することによって、乾燥気体がバイパスしてしまうことを防止し、乾燥気体を確実に中空糸束における中空糸の間隙を通風させることができる。

【0017】請求項5に記載の本発明の中空糸束の乾燥方法は、中空糸束を格納する少なくとも一端が開口し、かつ、上記開口部とは別に通気口を有するとともに、上記開口部の一部を閉塞する部材を設けた筒状体の、上記通気口に通気管を接続して上記筒状体の通気口から吸引通気せしめ開口部から排気することを特徴としたものである。

【0018】請求項6に記載の本発明の中空糸束の乾燥方法は、上記筒状体が中空糸モジュールのケーシングであることを特徴としたものである。

【0019】請求項7に記載の本発明の中空糸束の乾燥装置は、中空糸束を格納する少なくとも一端が開口し、かつ、上記開口部とは別に通気口を有する筒状体において、上記通気口に連結する通気管と、上記通気管を介して上記通気口に気体を送風および/または吸引する機構とを有することを特徴としたものである。

【0020】通気口の形状を一定としておけば、中空糸束の直径に影響されず、通気口連結機構の形状を変更せずに乾燥を続けられるため、多品種量産に適している。

【0021】

【発明の実施の形態】次に、本発明の実施例を図面を用いて詳細に説明する。なお、本実施例は本発明の形態を制限するものではない。

【0022】図1は本発明の中空糸束乾燥方法の一例を示す概略図である。

【0023】図1において、2は、中空糸束1を格納する円筒体であり、該円筒体の長軸方向両端部には開口部3、3'がそれぞれ設けられている。また、該筒状体の

両端部近傍における側面部に通気口4、4'がそれぞれ設けられている。該通気口4、4'にはさらに、該通気口4、4'を連通する通気管5が着脱自在に取り付けられている。なお、通気管5にはそれぞれの通気口4、4'を連通する配管の途中で乾燥気体を内部に導入、あるいは外部に排出する気体導出口6が設けられている。

【0024】通気管5の通気口4、4'への差込口は、通気口4、4'と同じ間隔で製作しておくことにより、生産工程において円筒体2を乾燥装置に設置する時、通気管5に対して通気口4、4'を差し込むだけで良いので、通気管5は可動式とする必要がない。

【0025】中空糸束1の乾燥に供する気体は、通気管5の気体導出口6から通気口4、4'に送り込まれ、中空糸束1内を通過して、開口部3に排出される。または、開口部3から中空糸束1内を通過して、通気口4、4'から通気管5に吸引され、気体導出口6から排出される。上記により、乾燥に供する気体を効率的に中空糸束1の端部のみに通過させることができる。

【0026】上記において、中空糸束1の直径に対して開口部3の直径が大きいと、乾燥気体が中空糸束1の側面を通過してしまい、効率的乾燥が実現できない。よって、図2に示すとおり、中空糸束1と開口部3、3'との隙間を閉塞する閉塞部材7、7'を用いて、乾燥気体のバイパスを防止するが可能である。

【0027】中空糸束1の素材としてはセルロース、ポリメチルメタアクリレート、ポリプロピレン、ポリサルフォン等が挙げられる。円筒体2、閉塞する部材7の素材については、耐久性を求めるならば鋼材を用い、軽量性を求めるならば樹脂を用いることができる。

【0028】乾燥気体は中空糸束素材、求める乾燥効果によって異なるが、中空糸束を求める速達または断熱性能を損なわない温度および湿度とすることが好ましい。

【0029】なお、筒状体として図3に示すように、中空糸モジュールケーシング8を用いてもよい。また、図3の装置に示すように、さらに閉塞部材7、7'を用いたのもであってもよい。

【0030】また、開口部3、3'はどちらか一方が閉塞されたものであってもよい。

【0031】

【実施例】実施例1

図3を用いて説明する。グリセリン水溶液を含有するポリサルフォン製中空糸14、688本を長さ248mmに切りそろえ、直径4.5mmの中空糸束1を形成した。上記中空糸束1を、内径46.5mm、開口径の52mmの中空糸モジュールケーシング8に挿入した。さらに、上記ケーシングの開口部3、3'に、ケーシング開口部3、3'の一部を閉塞するための部材7、7'を取り付けて、開口部3、3'の口径を、上記中空糸束直径と同じ4.5mmとした。そして温度40±2℃、湿度5

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 ±3%の乾燥雰囲気中に静置した上で、通気管5に設けた気体導排出口6から吸引して乾燥したところ、12分間の吸引で平均8.8g (n=3)の乾燥量を得た。吸引風速から算出した風量は、12分間で12.5m³であった。すなわち、1gの乾燥量を得るために、1.4m³の乾燥空気を要した。

比較例

図4を用いて説明する。実施例1と同様に作成した中空糸束1を中空糸モジュールケーシング8に挿入して、上記ケーシングの両端から温度40±2℃、湿度5±3%の乾燥空気を毎分2.4m³吹き付けたところ、11分間の吹きつけで平均10.0g (n=4)の乾燥量を得た。すなわち、1gの乾燥量を得るために、2.6m³の乾燥空気を要した。

【0032】

【発明の効果】以上より本発明によれば、中空糸束と、上記糸束を格納する格納する少なくとも一方が開口し、かつ、上記開口部とは別に通気口を有する筒状体からなり、乾燥雰囲気内にて上記筒状体の開口部と通気口とに通気せしめることを特徴とする中空糸束の乾燥方法を用いることにより、中空糸束の端部を選択的かつ効率的に乾燥するという効果を奏する。さらに好ましくは、実施*

* 例が示すとおり、筒状体開口径と中空糸束直径とは同一もしくは近似せしめた方が効果的である。

【図面の簡単な説明】

【図1】本発明の中空糸束乾燥方法の一例を示す概略図である。

【図2】本発明の中空糸束乾燥方法であって、筒状体開口部の一部を閉塞する部材をつけた場合の例を示す概略図である。

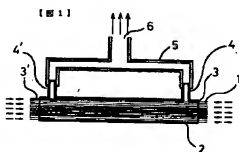
【図3】本発明の中空糸束乾燥方法であって、筒状体として中空糸モジュールケーシングを用いた場合の例を示す概略図である。

【図4】比較例に用いた装置の概略図である。

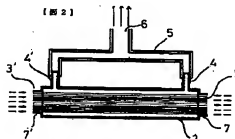
【符号の説明】

- 1：中空糸束
- 2：筒状体
- 3、3'：開口部
- 4、4'：通気口
- 5：通気管
- 6：気体導排出口
- 7、7'：閉塞する部材
- 8：中空糸モジュールケーシング
- 9、9'：第2流体口

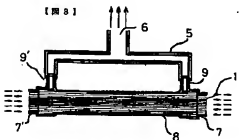
【図1】



【図2】



【図3】



【図4】

